# GEOSPATIAL ENHANCEMENT FOR NIEM (GEO4NIEM)

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# PM-ISE WIS3 "STANDARDS WAY AHEAD": PROMOTING NIEM & SDO COORDINATION

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in **November**

## WIS3 ROADMAP

As an outcome of the Workshop on Information Sharing and Safeguarding Standards (WIS3) in December 2011, **PM-ISE, in conjunction with industry and government standards organizations, created a roadmap to address:**

- Standards coordination and governance
- National Information Exchange Model
- Standards development and interoperability
- Identity and access management
- Policy automation
- Geospatial
- Procurement and standards testing and certification

## AN EMPHASIS ON GEOSPATIAL

**Integrate NIEM and Geospatial activities:**
- Standards Certification (OGC Testing/IJIS Springboard)
- Outreach
- Visualization Metadata
- Interoperability Pilots



Standards Way Ahead
February 2012

# OGC AT A GLANCE

**A non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location-based services.**

- Founded in 1994
- 480+ members and growing
- 38 implementation standards
- Hundreds of product implementations in the market
- Broad user community implementation worldwide
- Alliances and collaborative activities with ISO and many other SDO's



University 24%
Commercial 41%
Research 7%
NGO 10%
Government 18%
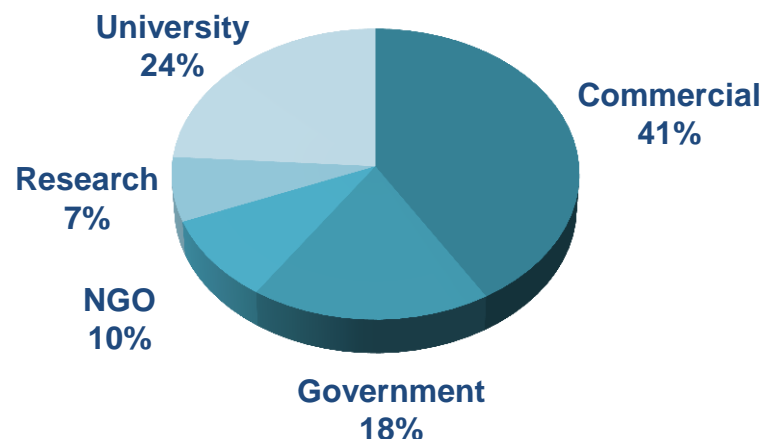
## OGC's Mission

To serve as a **global forum** for the collaboration of developers and users of spatial data products and services, and to advance the development of **open, international standards** for geospatial interoperability.

# GEOSPATIAL ENHANCEMENT FOR NIEM (GEO4NIEM)

**Develop and test recommendations for enhanced geospatial capabilities in NIEM**

- Use of geospatial enhancements in NIEM Naming and Design Rules and Adapters

- Use of embedded GML in NIEM Information Exchange Packages (IEPs)

- Test and demonstrate recommended practices for embedded GML and Adapters

- Develop architecture documentation and "Fact Sheet" for use of embedded GML and Adapters
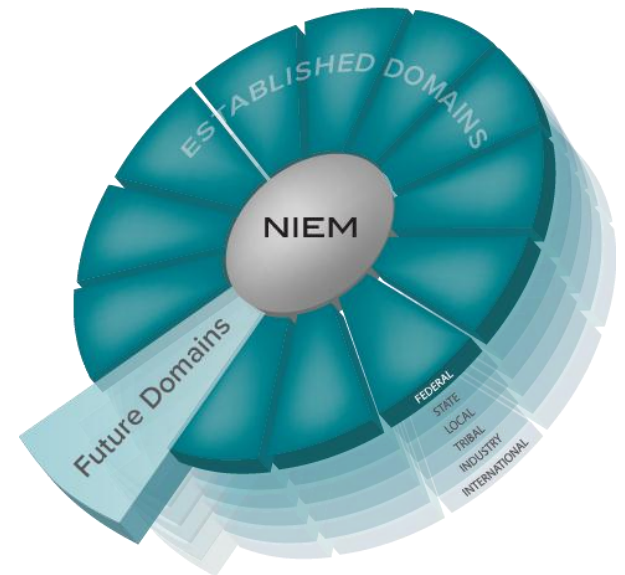
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# WHAT IS GML?
# (GEOGRAPHY MARKUP LANGUAGE)

- XML-based language for encoding geographic information to be stored and transported over the Internet

- Modeling language for geographic systems

- Open interchange format for geographic transactions on the Internet

- Defines both the geometry and properties of objects that comprise geographic information

# WHY GML?

- An international standard provides a common and well known language for expression of geographical features
- Features are more expressive than a coordinate pair by itself
  - Geometry, topology, temporal characteristics
  - Location, shape, extent, color, speed, density, etc.
- Expression of geographic location with an associated reference system
- Widely-used GIS platforms understand GML to display and integrate disparate geographic data sources (e.g., layers, types of data) in a Common Operating Picture

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# GML IN NIEM:
## EMBEDDED GML AND NIEM ADAPTERS

- Geography Markup Language (GML) v3.2.1, ISO 19136

- "Embedding GML Best Practice Paper" by Doug Nebert (USGS) (reference for starting position to describe embedded GML)

- NIEM v2.1
- NIEM Naming & Design Rules (NDR) v1.3

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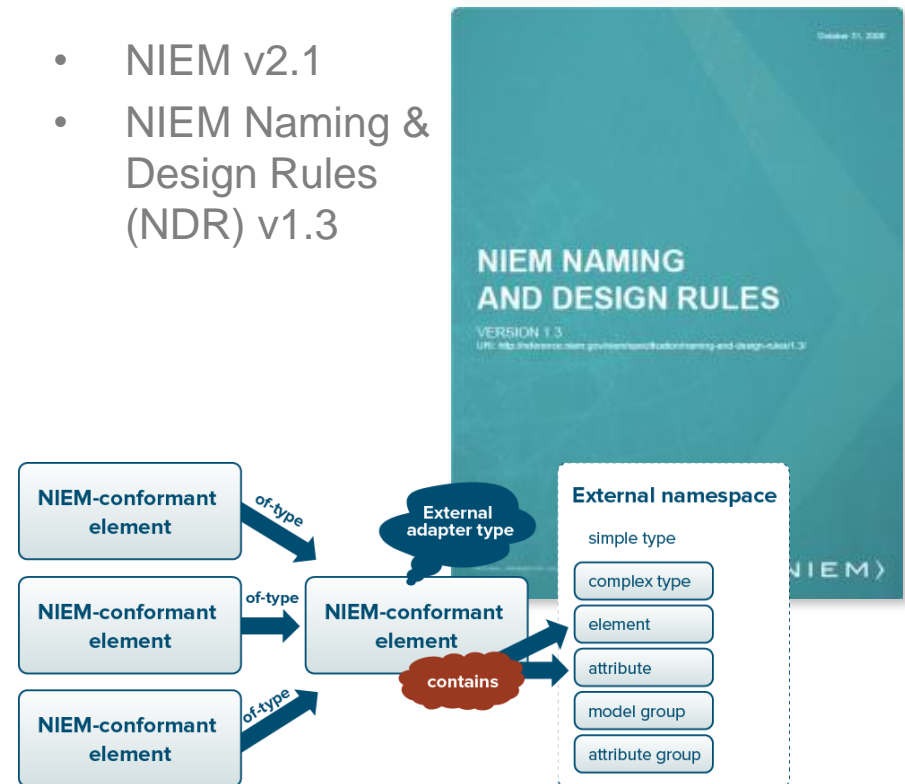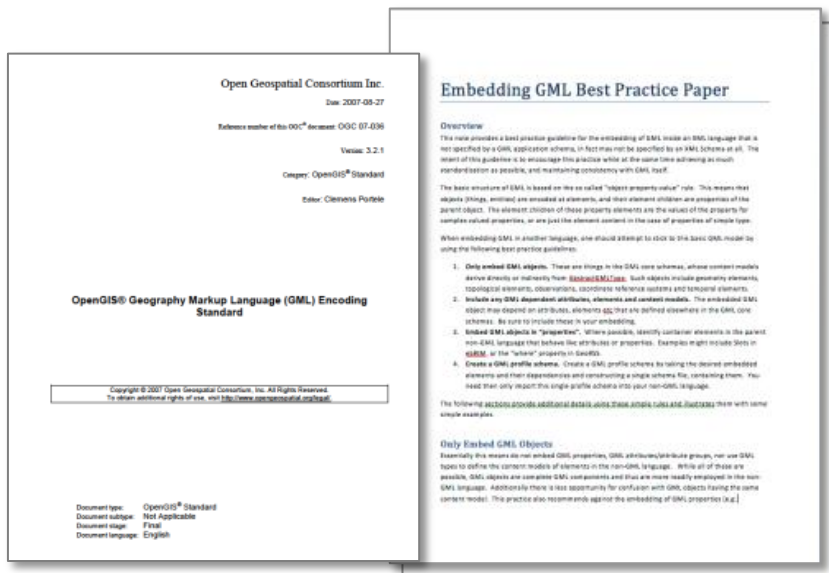
## RFI – Request for Information

- RFI is the mechanism through which intelligence analysts and operations managers can request and receive relevant information for processing and analysis connecting the collection step of the Intelligence Cycle with the Situational Awareness step of the Incident Management Cycle.

- Share and track an information request, including the *location* (coordinate and address) of the related incident.

## MDA – Maritime Domain Awareness (Vessel Position/Track)

- Maritime Domain Awareness is an inter-agency and international effort to detect and prevent threats at sea or in any navigable waterway.

- Share a number of packages of information that include vessel, cargo, and *location* information (coordinate, address, track, track bounding area) among other items.

# TERMINOLOGY FOR ARCHITECTURE AND DEMO

- "RFI IEP" and "Position IEP" refer to documents that conform to a NIEM 2.1 IEPD (RFI 2.1* or Position 3.2).

- "RFI GML" and "VesselTrack GML" refer to documents that conform to a GML application schema.

- The RFI 2.1 IEPD limits the Incident Location Type to an address we modified to allow only embedded GML point and polygon types via the NIEM External Adapter pattern.

# REQUEST FOR INFORMATION (RFI) SHARING USE CASE
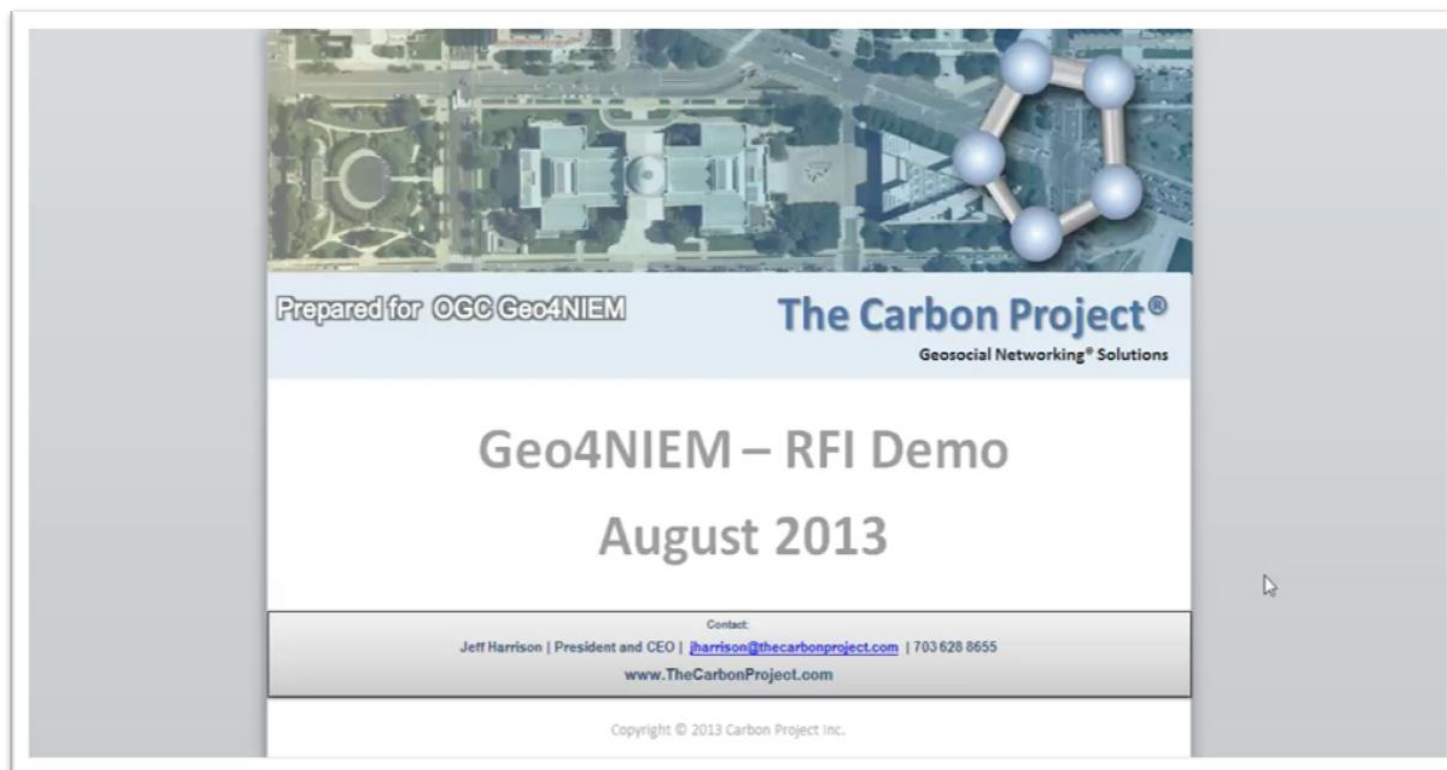
# MARITIME DOMAIN AWARENESS (MDA) VESSEL POSITION USE CASE

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# SUMMARY OF GEOSPATIAL ASSESSMENT AND RECOMMENDATIONS

# GEO4NIEM ENGINEERING REPORT

- "Summary and Recommendations of the Geospatial Enhancement for the National Information Exchange Model (Geo4NIEM) Interoperability Program Pilot" (OGC 13-054r1)

- The Engineering Report can be found at the following URL:
  - **http://www.opengeospatial.org/standards/per**

# SUMMARY OF FINDINGS

- **Existing NIEM adapter mechanism**

    – Found to be suitable for embedding GML geometry/feature elements (consistent with GML object-property model).

- **NIEM NDR 1.3 and GML 3.2.1**

    – Complying with both specifications was not possible due to conflicting constraints.

- **NIEM 2.1 geospatial adapter schema**

    – Includes elements that are not geometries. This is not a recommended practice.

- **Use of NIEM IEPs in OGC Web Services**

    – WFS was tested by transforming the IEP into a set of GML features conforming to a GML application schema.

    – For WFS, the transaction can contain either GML features (transform before WFS) or NIEM IEP (transform at WFS).

# SUMMARY OF FINDINGS (CONT)

- **NIEM - GML – NIEM round-trip**

  – A full round-trip is possible and partially tested in this initiative.

- **NIEM 2.1 `nc:LocationType`**

  – Has many potential elements, some that directly reference earth-referenced geometry and others that do not.

- **Geospatial data types**

  – Are not defined consistently across NIEM IEPDs.

- **NIEM 2.1 `nc:GeographicDatumCode`**

  – Uses an unfamiliar choice of codes.

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# GEOSPATIAL ENHANCEMENTS AND RECOMMENDATIONS

## GML Adapters in NIEM (based on geospatial.xsd)

- Update adapter types based on basic geometry types defined in GML Simple Features (OGC 10-100r3)
- Add a general-purpose Feature Adapter
  - Substitute for gml:AbstractFeature
  - Ex. Allows use of generic Feature in an IEPD, precise type defined in the instance data
- Add a general-purpose Geometry Adapter
  - Substitute for gml:AbstractGeometry
  - Ex. Allows use of generic Geometry in IEPD, precise type defined in the instance data
- Remove curve segment adapters
  - Redundant; they are not geometry types or GML objects themselves, rather constituents of gml:Curve, which already has an associated adapter
- Add Schematron constraints for GMLSF conformance (iaw GMLSF spec above)
- Deprecate the use of specific GML adapters; these should be declared in IEPD schemas using core adapter types.

# GEOSPATIAL ENHANCEMENTS AND RECOMMENDATIONS (CONT)

## GML Application Schema

- Map and transform NIEM IEPs into GML feature types in order to operationalize NIEM exchanges using OGC web services. (Note: Feature property is like a "NIEM Adapter" in GML app schema.)
- Capture NIEM message-level metadata into a separate metadata entity in the GML application schema instance.

## Using and Adapting OGC Web Services

- WFS v2 implementations can accept NIEM message formats and input and output formats (and internally transform to features).
- Consider using Catalog services for storing and retrieving shared information resources, such as MPD artifacts, code lists, service/data descriptions.

## nc:LocationType Updates

- Add gmlGeometry adapter to supply spatial references using geographic coordinates.
  - Earth-referenced geometry types
  - Geophysical/geopolitical types (e.g., postal address, cross street, gazetteer-type named locations)
- Consider and investigate use of TSPI v2 as a basis for location types throughout NIEM.
- Recommendations to correct issues such as the `nc:GeographicDatumCode` issue.
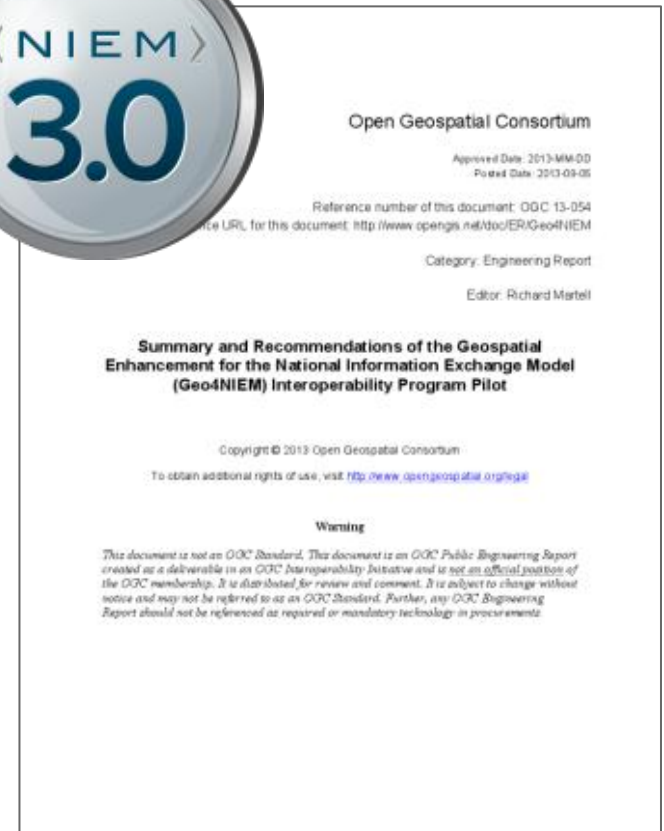
# GEO4NIEM & NIEM 3.0

- **No significant changes** recommended to the NIEM technical architecture

- NIEM Technical Architecture Committee (NTAC) **reviewed the eight recommendations** (specific to GML adapters in NIEM) for inclusion in NIEM 3.0

- **Seven recommendations implemented in NIEM 3.0**; one recommendation has no impact on the model itself

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- Revise adapter cardinality

- Support GML Simple Features (GMLSF) profile

- Define a generic feature adapter

- Define a general-purpose geometry adapter

- Remove adapters for curve segments

- Deprecate specific GML adapter elements

- Add the general-purpose geometry adapter to nc:LocationType

- Add Schematron constraints for GMLSF conformance

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**3.0**

Open Geospatial Consortium

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Category: Engineering Report

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**Summary and Recommendations of the Geospatial Enhancement for the National Information Exchange Model (Geo4NIEM) Interoperability Program Pilot**

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# POTENTIAL FUTURE WORK

- Test round-trip to consume and produce NIEM conformant information exchanges with OGC web services

- Information security and tagging

- Test recommendations for changes to `nc:LocationType`, shore up the types, correcting issues

- Test geocoding processes to produce feature content from NIEM information exchanges containing location types that do not directly reference earth-referenced geometry (addresses, road intersections, place names, etc.)

- Investigate mechanisms to attach/include generic "documents" as part of a NIEM information exchange

# THANK YOU!
# QUESTIONS?

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# THE OGC INTEROPERABILITY PROGRAM

- A global, collaborative, hands-on engineering, prototyping, and testing designed to rapidly deliver

    – Running code implementations

    – Engineering reports

    – Change requests

    – Demonstration in real world scenarios

- Sponsors and participants work together

    – Sponsors provide requirements, *use/business cases* and funding

    – Participants work with sponsors to define and/or refine standards to solve a given interoperability problem
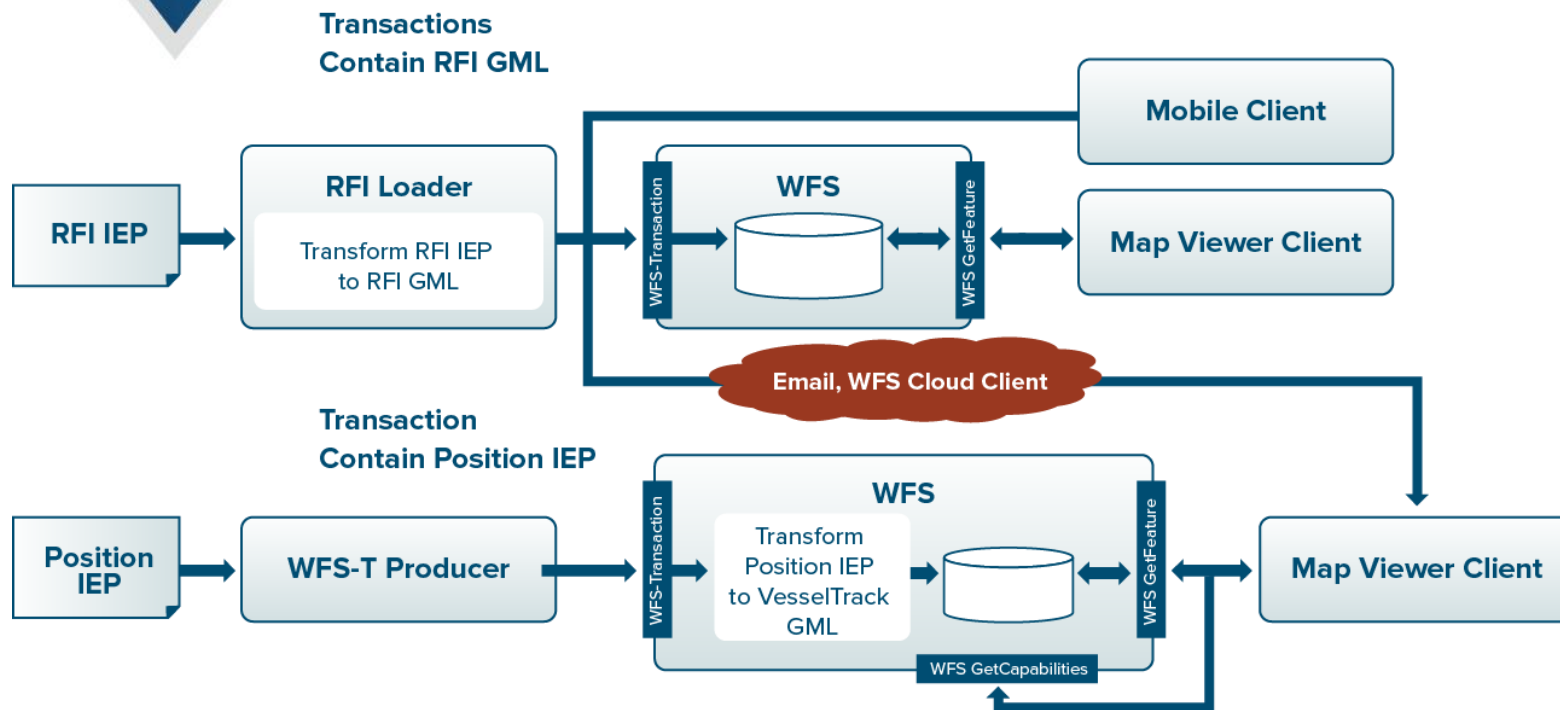
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